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GB 1447614 A DE 2808973 A SU 1088959 A

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(54) Road vehicle with electrolyser to generate hydrogen and oxygen for fuel

(57) The vehicle (2) comprises a body, wheels (4), an engine (6), a braking system, an electrical generator (8), coupled to at least one of the wheels (4), electrolyser means (10) for converting water into hydrogen and oxygen, and fuel supply control means (12) for controlling the supply of fuel for the engine (6). When the vehicle is moving, the electrical generator (8) generates electricity which is applied to the electrolyser means (10) consequent upon operation of the braking system in order to enable the electrolyser means (10) to convert water into hydrogen and oxygen, and the fuel supply control means (12) being such as to reduce the supply of fuel to the engine (6) in dependence upon the amount of hydrogen and oxygen generated.

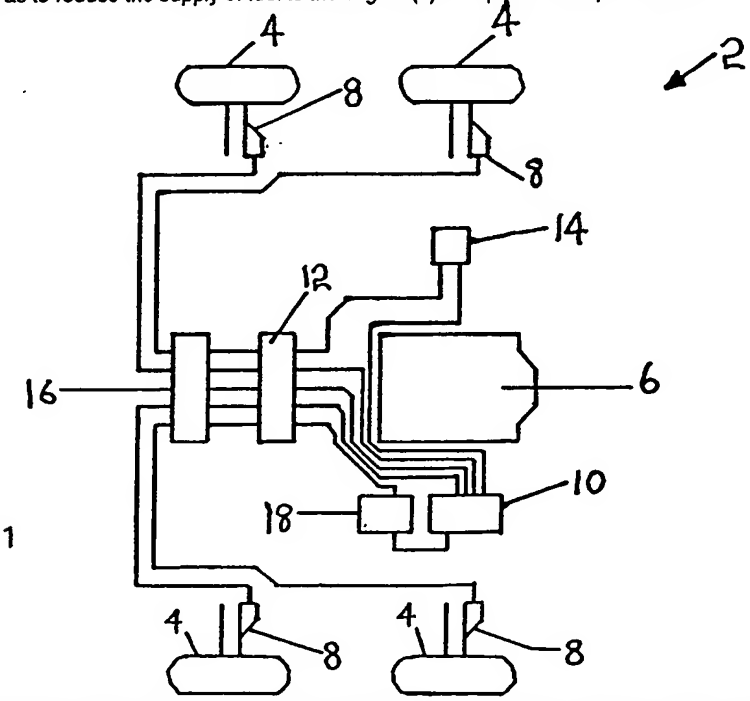

FIG 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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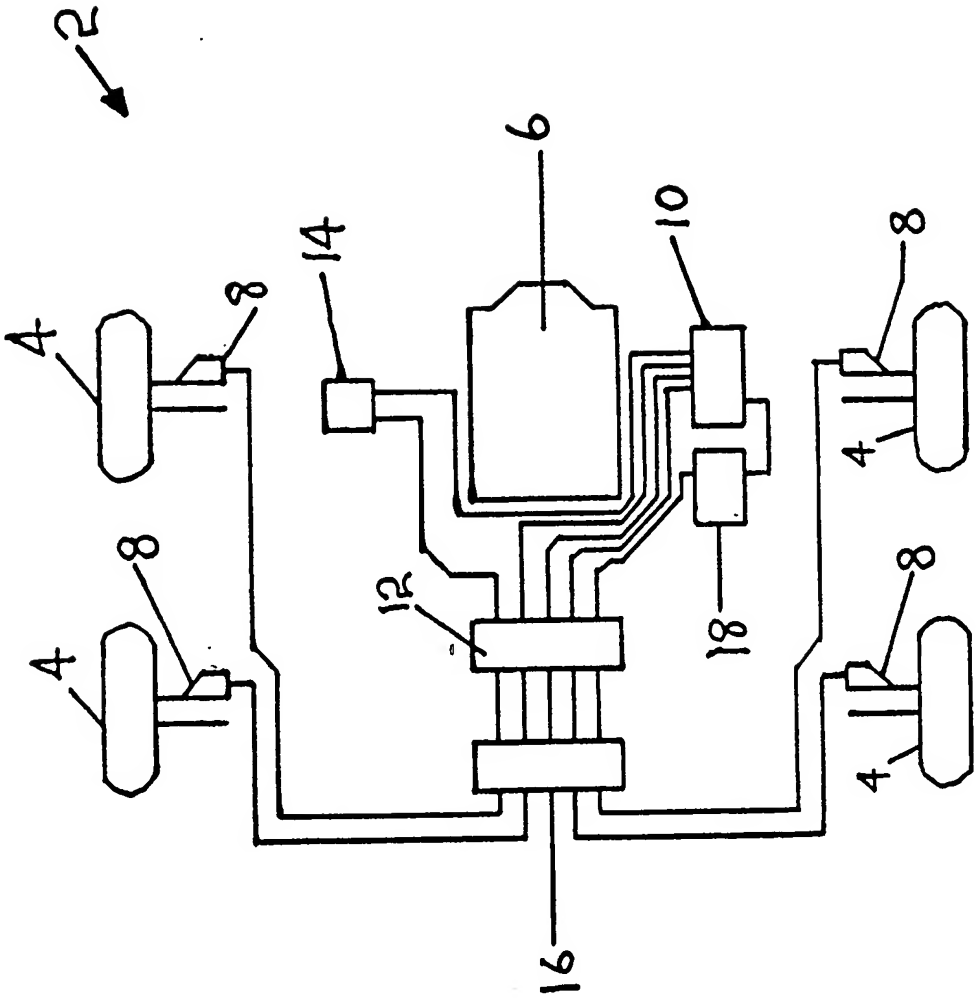

FIG 1

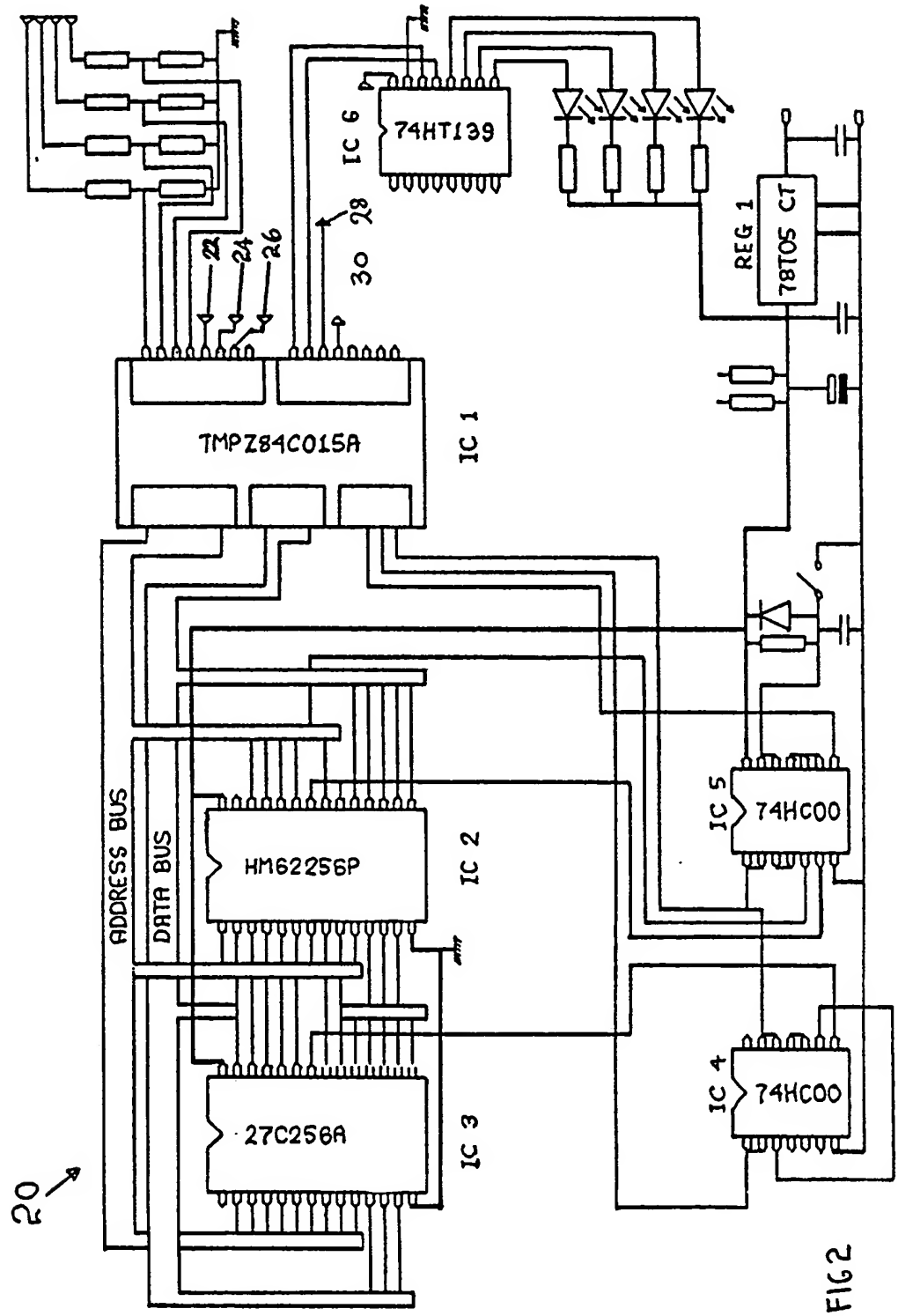
IC 6
74HT139
REG 1
78T05 CT
22
24
26
28
30
TMPZ84C015A
IC 1
ADDRESS BUS
DATA BUS
HM62256P
IC 2
IC 5
74HC00
27C256A
IC 3
IC 4
74HC00
20

FIG2

A ROAD VEHICLE

This invention relates to a road vehicle and, more especially, this invention relates to a road vehicle which is able to operate with a reduced fuel consumption.

Road vehicles are known which are provided with various types of apparatus for reducing the fuel consumption of the road vehicles. It is believed that none of the known road vehicles effect a fuel saving using the normally wasted energy of vehicle braking. It is an aim of the present invention to provide a road vehicle having such fuel saving apparatus.

Accordingly, in one non-limiting embodiment of the present invention, there is provided a road vehicle comprising a body, wheels, an engine, a braking system, an electrical generator coupled to at least one of the wheels, electrolyser means for converting water into hydrogen and oxygen, and fuel supply control means for controlling the supply of fuel for the engine, the road vehicle being such that when it is moving the electrical generator generates electricity which is applied to the electrolyser means consequent upon operation of the braking system in order to enable the electrolyser means to convert water into hydrogen and oxygen, and the fuel supply

control means being such as to reduce the supply of fuel to the engine in dependence upon the amount of hydrogen and oxygen generated.

The road vehicle of the present invention is thus able to convert energy normally discarded as heat from the operation of the braking system into usable fuel in the form of the hydrogen and the oxygen. The fuel so generated can be directed to the engine to supply the needs of the engine for a period proportional to the amount of electrical energy recovered from the braking system.

The road vehicle is such that the energy normally discarded as heat from the braking system during the reduction of speed of the road vehicle, is electrically converted by the electrical generator into a usable fuel for the vehicle. The generated fuel in the form of the hydrogen and the oxygen is able to be mixed with a greatly reduced amount of the vehicle's normal fuel supply in order to enable the generated fuel relatively closely to match the characteristics of the normal fuel. Advantageously, the generated fuel, that is the hydrogen and the oxygen, contains no harmful exhaust products and the recombination of unused hydrogen and oxygen produces only water vapour. For example, a litre of oxygen and hydrogen produces approximately 0.6g of water.

The road vehicle is preferably one in which the electrical generator is driven by its wheel without an electrical load during normal driving conditions.

Preferably, the engine is an internal combustion engine. The engine may be a 4-stroke engine driven by a petroleum fuel, or the engine may be a 2-stroke engine driven by a petroleum and oil fuel mixture. If desired, the engine may be a rotary-type engine or a diesel engine.

Preferably, the fuel supply means includes a microprocessor.

The road vehicle may be one in which the fuel is supplied to the engine via a carburettor, and in which the control means controls the operation of the carburettor. The control means may control one or more valves in the carburettor. The valves may be butterfly-type valves or needle-type valves, depending upon the type of fuel supply/injection utilised in the road vehicle.

The road vehicle will usually be one having four wheels. If desired however the road vehicle may have three wheels, or it may have two wheels as for example in the case of a motorbicycle.

The road vehicle may generally be a car, van, bus, lorry, coach or motorcycle.

An embodiment of the invention will now be described solely by way of example and with reference to

the accompanying drawings in which:

Figure 1 shows the layout of a road vehicle; and

Figure 2 shows the electrical circuit used in the road vehicle of Figure 1.

Referring to Figure 1, there is shown schematically in plan view a road vehicle 2 comprising a body (not shown), wheels 4, an engine 6, a braking system (not shown), and an electrical generator 8 coupled to each one of the wheels 4. The road vehicle 2 further comprises electrolyser means 10 for converting water into hydrogen and oxygen. The road vehicle 2 still further comprises fuel supply control means 12 for controlling the supply of fuel for the engine 6.

The road vehicle 2 is such that when it is moving, the electrical generators 8 generate electricity which is applied to the electrolyser means 10 consequent upon operation of the braking system in order to enable the electrolyser means 10 to convert water into hydrogen and oxygen. The fuel supply control means 12 is such as to reduce the supply of fuel to the engine 6 in dependence upon the amount of hydrogen and oxygen generated. The electrical generators 8 are such that they are driven by their wheels 4 without an electrical load during normal driving conditions of the road vehicle 2.

As can be seen from Figure 1, the road vehicle 2 further comprises a carburettor 14, a relay and sensing system 16 and a water tank 8 for containing water to be electrolised.

Referring now to Figure 2, it will be seen that there is shown a circuit 20 for use with the road vehicle 2 shown in Figure 1. The circuit 20 shows somewhat schematically a footbrake switch 22, a water level switch 24, and a gas pressure switch 26. Also shown in Figure 2 are a fuel bypass switch 28 and a valve drive switch 30. Also shown in Figure 2 are integrated circuits IC1, IC2, IC3, IC4, IC5 and 1C6.

The circuit 20 operates generally such that the electrical generators 2 are driven by the wheels 4 without an electrical load. When the braking system of the road vehicle 2 is activated, the electrical outputs of the electrical generators 8 are connected as indicated above to the electrolyser means 10 in order to convert water from the water tank 18 into hydrogen and oxygen. Simultaneously, the carburetion of fuel, for example petrol, is reduced by valves (not shown) on the carburettor 14, under the control of a microprocessor which forms part of the fuel supply control means 12. As hydrogen and oxygen are liberated in the electrolyser means 10, the hydrogen and oxygen is allowed into the carburettor 14

to be mixed with a greatly reduced amount of fuel. The purpose of allowing some residual fuel into the engine 6 is to reduce the rather high flame temperature of pure oxygen and hydrogen which may be in the region of 3300°C, and also so as not to vary the characteristics of the fuel too greatly. The microprocessor in the fuel supply control means 12 is the integrated circuit 1C1 which is preferably a Toshiba microprocessor TMPZ84C015A.

The fuel supply control means 12 may utilise a central processor in the form of a TLCS-Z80 type central processor. This part of the overall microprocessor control unit is a high performance CMOS 8 bit processor which incorporates a counter timer circuit, a parallel input/output port, and a clock generator/controller, all housed in one 100 pin device. The counter timer circuit consists of four independent channels which can be set as either timers or counters. The parallel input/output port consists of two programmable independent 8 bit input/output ports. All the ports are addressed in the input/output space internally, thus removing the need for a discrete decoder.

The integrated circuit IC3 comprises a read only memory in the form of a 27C256A EPROM which is a 32k X 8 bit part and which holds the control programme for the controller. The integrated circuit IC2 is a random access

memory which is a 32k x 8 bit part and it is used to hold data also as a scratch pad area. The system memory map is thus divided into a stored programmed, a scratch pad, data and input/output areas.

The parallel input/output port bit assignments are as follows:

PARALLEL INPUT/OUTPUT PORT A

Bit 0 = Input from Gensense0

Bit 1 = Input from Gensensel

Bit 2 = Input from Gensense2

Bit 3 = Input from Gensense3

Bit 4 = Input from Footbrake switch 22

Bit 5 = Input from Water level switch 24

Bit 6 = Input from Gas pressure switch 26

Bit 7 = Input from Gas max switch

PARALLEL INPUT/OUTPUT PORT B

Bit 0 = Output to LED display

Bit 1 = Output to LED display

Bit 2 = Output to genswitch relay

Bit 3 = Output to carbsol

Bit 4 = Spare

Bit 5 = Spare

Bit 6 = Spare

Bit 7 = Spare

PARALLEL INPUT/OUTPUT PORT A

As may be seen from the above, bits 0-3 of the input port P.I.O. /A are used to detect the presence of a suitable voltage from each of the electrical generators 8. This is achieved by sampling a proportion of the rectified output of the generators 8 through a potential divider which feeds a schmitt trigger. The potential divider is designed so that at low road speeds, its output is below the level required to trigger the schmitt trigger. The purpose of testing the output of the electrical generators 8 in this way is twofold.

Firstly, the testing ensures that all the electrical generators 8 are functioning satisfactorily. This is done on an individual basis and also on a comparative basis. The individual outputs are then compared to the other outputs. Should any discrepancy occur, then a warning is displayed via bits 0-1 (4 states) of P.I.O. / B. The second purpose of testing is that the combined outputs of the generators 8 are used to indicate that the road vehicle 2 is travelling above the minimum required speed to allow the electrolyser means 10 to be enabled. This precaution is necessary to ensure that the microprocessor control unit will discriminate between the normal on/off braking of the road vehicle 2 at very low speeds, eg at speeds lower than ten miles per hour, where there will be very little oxygen/hydrogen production,

and at higher speeds, for example above ten miles per hour, where the production of oxygen and hydrogen will be greater.

Bit 4 of P.I.O. / A is used to sense the state of the footbrake switch 22. This information is used in combination with the other inputs, if the conditions are appropriate to activate the electrolyser means 10. In this way, it can be ensured that the electrical generators 8 come into action slightly before the braking system.

Bit 5 of P.I.O. / A is connected to a water level switch 24 which monitors the level of water in water tank 18. If the average reading from the water level switch 24 indicates that the water in the water tank 18 is low, then the operation of the electrolyser means 10 is inhibited and appropriate information is displayed to a driver of the road vehicle 2. Operation of the electrolyser means 10 is suspended until the water tank 18 is provided with more water. Normal driving is not interferred with in any way. The outputs from the electrical generators 8 are simply automatically disconnected from the electrolyser means 10.

Bit 6 of P.I.O. / A is used to sense the output of the gas pressure switch 26. After a quantity of the produced hydrogen and oxygen gas, as measured by the gas pressure switch 26, has been consumed by the engine 6, the gas pressure drops to a point where the gas pressure switch 26 closes. This is detected by the bit 6 of the

P.I.O. and the fuel supply control means 12 deactivates the electrolyser means 10, returning the road vehicle 2 to operation with its normal fuel supply.

Bit 7 of the P.I.O. / A is used to sense any condition arising whereby, if the pressure exceeds a safety switch setting, operation of the electrolyser means 10 is inhibited and the excess pressure is relieved by venting into the engine 6. An indication of such a pressure condition would be displayed to the driver of the road vehicle 2. After the venting, the electrolyser means 10 will be disabled until the underlying fault has been corrected. The road vehicle 2 will still function in the normal way, but without the benefit of the electrolyser means 10 producing the auxiliary oxygen and hydrogen gaseous fuel mixture.

Due to the hazardous nature of a oxygen and hydrogen mixture in inexperienced hands, appropriate safeguards are advantageously provided. Thus, for example, in the event of tampering with the sealed electrolyser means 10, hidden electrical fuses may be arranged to be broken to prevent further use of the gas generating system. As previously, the road vehicle 2 will continue to function normally, but without the benefits of fuel savings.

Parallel input/output port B

Bits 0-1 are connected to one half of a 74HC139 CMOS dual 2-to-4 line decoder. The decoded outputs are connected to a light emitting diode display which consists of single light emitting diodes as indicators of system performance to the driver of the road vehicle 2.

Bit 2 is the output to the Genswitch relays. These relays switch the rectified outputs of the electrical generators 8 to the electrolyser means 10. The bit 2 output is buffered by a power transistor to each relay input.

Bit 3 is connected to a solenoid of the carburettor 14, via a driving power transistor. The solenoid is so arranged as to reduce the amount of fuel, for example petrol, available to the engine 6 during production of the gaseous oxygen/hydrogen, the reduction of the fuel being effected by blocking the main jet of the carburettor 14.

Bits 4-7 are spare.

RAM ROM

The memory map is divided into two, with the lower 32767 bytes designated as ROM and the upper 32767 bytes addressed as RAM. This arrangement allows for a very simple design of memory decoder. Address line A15 is used directly as the /CS enable line for the bottom 32k of memory (0000h - 7FFFh) assigned to the ROM. The

/OE signal for the ROM is derived by inverting the /RD and the /MREQ signals from the processor and NAND gating them in the integrated circuit IC4.

The address line A15 is NANDed (integrated circuit IC5) with the inverted /MREQ from the central processor unit. This signal is then applied to the /CS enable line for the upper 32k (8000h-FFFFh) which is assigned to the RAM.

COUNTER TIMER CIRCUIT

The counter timer circuit is divided into four independent channels. These channels have the following input/output addresses.

Ch0 = 10h

Ch1 = 11h

Ch2 = 13h

Ch4 = 14h

Channel 0 is used to generate an interrupt every 50mS. This interrupt is serviced by a routine which reads P.I.O. port A. The data thus read is analysed and as described above, the corresponding bit pattern is acted upon. Whilst the counter timer circuit is programmed to provide a 50mS interrupt, this interrupt is disabled immediately after the data has been read and until it has been acted on by the system. On completion of the resulting

routines, the interrupt is enabled again. This scheme ensures that any change in external conditions will be reported to the processor with the minimum of delay.

During operation of the road vehicle 2, the electrolyser means 10 operates to electrolyse the water to produce a mixture of two parts of hydrogen and one part of oxygen. This combination of gases is often known as oxyhydrogen. The gases burn with a flame temperature of approximately 3300°C. To reduce this high temperature, the gas is mixed with a small amount of fuel, thus also adding to the thermal energy available.

It is to be appreciated that the embodiment of the invention described above with reference to the accompanying drawings has been given by way of example only and that modifications may be effected. Thus, for example, the illustrated road vehicle 2 has four wheels but this vehicle may be replaced by another road vehicle having more or less than four wheels.

CLAIMS

1. A road vehicle comprising a body, wheels, an engine, a braking system, an electrical generator coupled to at least one of the wheels, electrolyser means for converting water into hydrogen and oxygen, and fuel supply control means for controlling the supply of fuel for the engine, the road vehicle being such that when it is moving the electrical generator generates electricity which is applied to the electrolyser means consequent upon operation of the braking system in order to enable the electrolyser means to convert water into hydrogen and oxygen, and the fuel supply control means being such as to reduce the supply of fuel to the engine in dependence upon the amount of hydrogen and oxygen generated.

2. A road vehicle according to claim 1 in which the electrical generator is driven by its wheel without an electrical load during normal driving conditions.

3. A road vehicle according to claim 1 or claim 2 in which the engine is an internal combustion engine.

4. A road vehicle according to any one of the preceding claims in which the fuel supply means includes a microprocessor.

5. A road vehicle according to any one of the preceding claims in which the fuel is supplied to the engine via a carburettor, and in which the control means controls the operation of the carburettor.

6. A road vehicle according to claim 5 in which the control means controls one or more valves in the carburettor.

7. A road vehicle according to claim 6 in which the valves are butterfly-type valves or needle-type valves.

8. A road vehicle substantially as herein described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

9124229.7

Relevant Technical fields

(i) UK Cl (Edition K) B7H (HDA, HDY); F1B

(ii) Int Cl (Edition 5) B60K 15/10; F02B 47/06; F02D 19/02

Search Examiner

J L TWIN

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Date of Search

26 FEBRUARY 1992

Documents considered relevant following a search in respect of claims

1

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 1447614 (BLUE ET AL)	1
X	DE 2808973 (DAIMLER-BENT)	1
X	SU 1088959 (EGIN)	1

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Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

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